

The rate of disintegration of the radio-active bodies is also independent of their state of chemical combination, which indicates that the radio-active properties belong entirely to the so-called atom of the radio-active element present, and are not communicated to the other atoms present in the compound.

It thus appears that the atoms of the so-called elements contain an immense store of energy, and this discovery leads to interesting possibilities which Prof. Rutherford discusses in connection with the heat supply of the sun and earth, and other heavenly bodies. If the sun and earth draw their heat-supply from this store, then it is possible that the present rate of emission may have been going on for vastly longer ages than those hitherto supposed possible, longer even than the ages demanded by geologists for the completion of the processes of formation of the earth's crust.

Exception may be taken to the terminology adopted in some parts of the book. For example, the product of decomposition of the radium emanation which is deposited on solid bodies is referred to as "emanation-X." It would probably be better to reserve the term emanation for radio-active gases; but at the same time, it must be admitted that "emanation-X" is a better name than "induced radio-activity."

The arrangement of the matter and its treatment are throughout admirable.

Mr. Soddy's book on radio-activity contains an excellent and interesting account of the subject. The arrangement of the matter and point of view adopted are very similar to those in Prof. Rutherford's book, of which Mr. Soddy's is practically an abridged and slightly popularised edition.

Messrs. Levy and Willis's book on radium is supposed to be of a popular character, and contains an account of many of the properties of radio-active bodies. The arrangement of the matter cannot be commended, and the authors' scientific knowledge does not appear to have been sufficient for the task they have undertaken. Facts and results which it is suggested might be obtained if looked for are mixed up in a manner calculated to confuse the reader; there are besides many inaccurate statements. It is difficult to see what useful purpose this book can serve.

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BOOKS ON PLANT-PHYSIOLOGY.

The Physiology of Plants, a Treatise upon the Metabolism and Sources of Energy in Plants. By Prof. W. Pfeffer. Second fully revised edition. Translated and edited by Dr. Alfred J. Ewart. Vols. i. (pp. xii + 632) and ii. (pp. viii + 296). (Oxford: at the Clarendon Press, 1900 and 1903.)

Vorlesungen über Pflanzenphysiologie. By Prof. Ludwig Jost. Pp. xiii + 695; with 172 illustrations. (Jena: Gustav Fischer, 1904.) Price 13 marks.

PROF. PFEFFER is to be congratulated on the completion of his great task—the re-writing, in the form of a second edition, of his well known "Pflanzenphysiologie." The present edition, of which the first instalment appeared in 1897, consists

of what are practically three volumes containing some 1600 pages. Of these, the two first volumes are before us in an English translation.

The book is a unique one, for it is certain that none has ever appeared giving so complete an account of the physiology of plants. It must be remembered, too, that during the past forty years this branch of science has, through the labours of Sachs, Pfeffer, and a crowd of other workers, made great advances; and has developed into a huge mass of inter-related problems, so that the subject-matter is far more extensive than that which any previous writer has had to deal with. To form some notion of the activity of this department of botany, it is sufficient to look at the references which crowd the pages of the book.

It is perhaps owing to the mass of new matter which had to be incorporated that Pfeffer has somewhat condensed his presentment of general results. This has some disadvantages, inasmuch as the reader misses the give and take of a full discussion. He gets, it is true, the matured judgment of the author, but he gets it condensed to a somewhat dry and cold essence in which the quality of attractiveness is sacrificed. In what forms the main tissue of the book—the detailed consideration of experimental evidence—Pfeffer is at his best, and rules his armies of facts with the easy authority of one who is not only deeply learned, but experienced at first hand with every part of his subject.

The book follows the broad natural division of the subject into "Stoffwechsel" and "Kraftwechsel," that is, into one volume on metabolism—roughly speaking, nutrition—and two volumes on growth, movement and development. The most notable new feature in vol. ii. of the English edition is the prominence given to "causes of specific shape"; this change is the natural outcome of the recent increase of interest in this field of work, for instance in the researches of Vöchting, Goebel, Klebs, Driesch, &c. In consequence of the greater space given to this department (in itself a decided improvement in the new edition), the attention given to the special physiology of growth is relatively diminished as compared with the old edition. The volume also contains short discussions on heredity, variation, and allied questions. It is useful to know the author's views on questions of fundamental importance, but apart from this consideration we doubt whether these sections are quite worth giving in a book of this character, since it is impossible for the author to give space for an amount of discussion such as the problems demand. However this may be, and such points are largely a matter of individual opinion, on the main point there can be no doubt; no one can question the value of such a mass of information grouped in logical sequence, connected by the thoughts and criticisms of the leading plant-physiologist of the present day, and representing the mature result of a long life of strenuous and successful work.

Dr. Ewart, who has made the English translation, is well qualified for the work, being an accomplished physiologist, and his occasional remarks added in the capacity of editor are of value. The task of translating German requires a certain courage as well as

skill; the original sentences have to be individually annihilated before endurable English equivalents can be raised from their ashes. This Dr. Ewart has done so well that the book reads as though it had been written in English.

No one can nowadays write a physiological textbook without being largely indebted to Pfeffer's "Pflanzenphysiologie," and this, in his preface, Prof. Jost acknowledges in the fullest way; but his book is so different from Pfeffer's in scope and manner of presentment that it is essentially an original work.

It is an eminently readable and useful book; it is written in a clear and easy style, and steers a skilful course between some of the difficulties that beset the lecturer. On the one hand the author avoids placing too much stress on what is new, while he by no means neglects the recent literature, and is thoroughly up-to-date in his treatment of the subject. He is not afraid of facing a difficulty or of pointing out where our knowledge fails to solve the problem. He has produced a book admirably suited to the advanced student of an English university, and one that may also be read with advantage by more advanced workers. Jost's manner of stating his case is so suggestive, and he is so open in pointing to possible lines of inquiry, that the book cannot fail to be useful to a wide class of readers.

It is divided into three parts:—(1) Stoffwechsel, (2) Formwechsel, (3) Energiewechsel. Part i. deals with the absorption, transport, and loss of water, with the assimilation of carbon and nitrogen, and with respiration and fermentation. Under Formwechsel (part ii.) we have a general statement of the fundamental problems of development, then come growth and development under constant conditions. This is followed by the effects of the environment on growth, &c., and finally comes a section on periodicity, inheritance, and variation. Part iii. (Energiewechsel) deals with hygroscopic movements, growth-curvatures ("tropisms"), the movements of tendrils, of sleeping plants, &c., and chemotaxis, &c. The whole of part iii. seems to us particularly good, and contains much that is interesting and valuable in the way of discussion. We confidently recommend Prof. Jost's lectures, but since it is the duty of the reviewer to find some fault, we may direct attention to Fig. 141, which is printed upside down.

F. D.

CHRONOLOGICAL CALCULATIONS.

Astronomical and Historical Chronology in the Battle of the Centuries. By William Leighton Jordan, F.R.G.S., F.S.S., &c. Pp. 70. (London: Longmans and Co., 1904.) Price 2s. net.

THE main object of this little work is to contend that what is sometimes called the "astronomical" method of dating events prior to the Christian era is really what was intended to be used when the system of using dates before and after the birth of Christ was first introduced. Hence it is dedicated to the librarians of the cities of Florence and Pisa, in the hope of receiving from some of them "further evidence for the elucidation of the subject."

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Now divisions of this kind involve the drawback of necessitating a reckoning in two directions. This is also the case, for instance, in the centigrade division of the thermometric scale, which is nearly always avoided by the general public in this country, and would be still more in countries which are nearer the equator, by using Fahrenheit's scale, the zero being below the lowest point usually reached in winter, so that a statement of the reading is sufficient, without adding above or below freezing, as the case may be. In dating an event, too, by Christian chronology, we have to state whether it occurred before or after the birth of Christ (or the year accepted as such), which is indicated by affixing the letters B.C. or A.D. But there is this further complication, as compared with a thermometric or other scale, that a degree is a definite point, and everybody knows that 1° below freezing is two degrees below 1° above it. A year is not a definite point of time, and we all know (having had a recent instance of it) what perplexity is caused in many minds when a new century has commenced with regard to which is the first year thereof. Our author reminds us, for instance, how the German Emperor insisted that the present (twentieth) century began at the beginning of the year 1900. A further complication is contained in the fact that we do not know exactly the date of Christ's birth.

But although that question is very interesting from an historical point of view, it is too late now to treat of it as a matter affecting our system of chronology. This is based on the assumed fact that the traditional date of the birth of Christ is the end of the year B.C. 1, so that one year after it was completed at the end of A.D. 1, a century at the end of A.D. 100, nineteen centuries at the end of A.D. 1900, and the twentieth century commenced on January 1, A.D. 1901.

Some people not versed in chronological calculations fancy that astronomers go out of their way to differ from ordinary people when they call the year which is commonly reckoned B.C. 1 (the year preceding A.D. 1) 0, and denominate B.C. 2 as the year - 1. But there is no such affectation of singularity in the matter; a necessity is laid upon the computer in this respect, for if we subtract 1 from 1, the result cannot be anything but 0, and if we subtract 2 from 1, the result must be -1. It is necessary, therefore, to remind ordinary people that if they desire to estimate the number of years from a date in B.C. reckoning to one at the same season in A.D. reckoning, it is not sufficient to add the years together, but unity must be subtracted from the result; from June 1, B.C. 10, for instance, to June 1, A.D. 10, is an interval of not twenty, but only nineteen years.

The author of the work before us desires to prove that those who first used Christian chronology intended that it should be reckoned in this way, the numbers being not cardinal, but ordinal. However, that is a mere matter of curiosity. An inmate of a lunatic asylum, who appeared sane to a visitor, was once asked why he was there. "Oh," he said, "I thought everybody else was mad, and they thought I was; as they were in the majority, they had their way with me, and so I am here."